subjecting them to direct sunlight after contact, only one showed a slight reaction.

The three subjects who were highly susceptible to *Ptelea angustifolia* were also tested for susceptibility to *Dictamnus albus* (gas plant) and *Ruta graveolens* (rue). Subject 2 was highly susceptible to all three species. Subjects 1 and 3 showed no reaction to *Dictamnus albus* and a slight reaction to *Ruta graveolens.*

Summary

Contact with the leaves of *Ptelea angustifolia* causes a dermatitis in susceptible individuals. Exposure to direct sunlight subsequent to contact increases the severity of the dermatitis. This suggests that *Ptelea angustifolia* has a photosensitizing action. The dermatitis caused by *Ptelea angustifolia* is very similar to that produced by *Dictamnus albus* and *Ruta graveolens.* In the experimentally produced dermatitis the first inflammation appeared eighteen to thirty hours after contact with the leaves. The severe cases continued for about ten days.

Department of Botany,
Cornell University,
December, 1943.

ON THE SHOOT APEX OF CHLOROGALUM POMERIDIANUM (DC.) KUNTH[1]

Clarence Sterling

Recent investigations on the structure of apical meristems have rekindled interest in the cyto-histology of the shoot apex as contrasted to the more static formulation of cell-wall patterns. (See reviews by Foster, 5; 6.) One of the main services of these studies has been to show the essential lability inherent in plant tissues and the consequent inadmissibility of posing strict categories and formulae within which plant life is to function.

Probably one of the most rigid "laws" imposed on the angiosperm shoot apex is that it have at least one stratum of cells which experiences anticlinal divisions exclusively, this cell layer being called variously a "dermatogen" or "tunica." Very few exceptions to this basic rule have been noted. Magnus (7) indicated divisions in the dermatogen of the tip of the lateral pistillate inflorescence of *Secale cereale;* Pottier figured such a pericline at the tip of a branchlet of *Ruppia maritima* (8, fig. 77) and in the apical meristem of the shoot of *Cymodocea nodosa* (8, fig. 197); and more recently Sharman (11, 12) found periclines at the summits of the

[1] The writer wishes to acknowledge the helpful advice and criticism of Dr. A. S. Foster in the preparation of the manuscript.

shoot apices of *Zea mays* and *Agropyron repens,* respectively. The apices of *Phoenix,* as figured by Ball (2), also indicate irregularities in the uniseriate tunica, possibly involving sporadic periclines. Aside from phylogenetic implications for the monocots, these observations have a significance in challenging fixed concepts on the structure of the angiosperm shoot apex.

The present discovery resulted during experimentation on shoot apices with various fixatives. One of these experiments

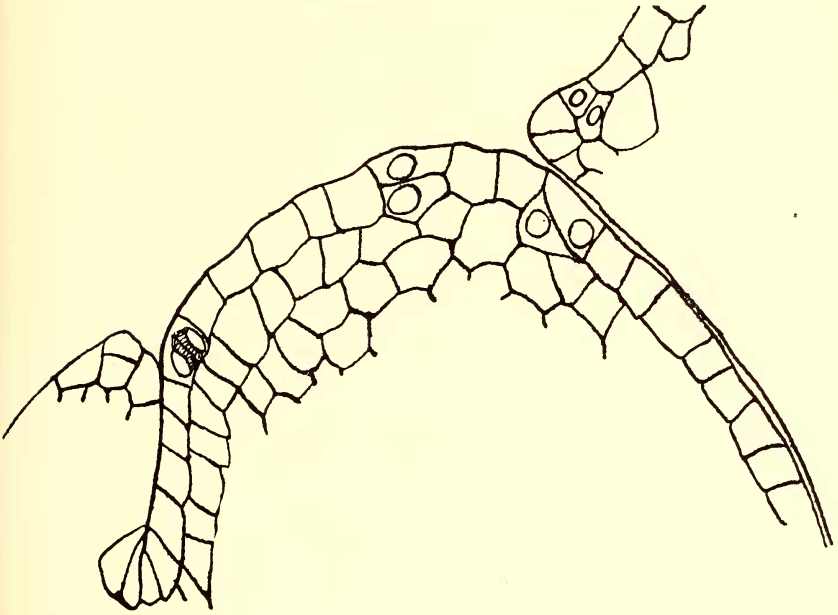

FIG. 1. Longitudinal section in near-median view of shoot apex of *Chlorogalum pomeridianum* (×485).

involved specimens of *Chlorogalum pomeridianum,* collected in April, 1941, near Fairfax in Marin County, California. Slides were made of the shoot apices of two bulbs. The sections were serial longitudinal, cut eight micra thick. Because of poor fixation of the apices, drawings were made by the camera lucida technique.

One of the apices, perhaps cut somewhat obliquely, shows only slight indications of previous periclinal divisions in the surface layer of cells. In the second apex, there is very definitely no discrete surface layer. Periclinal divisions have occurred at various places in this layer, both at the summit and on the flanks, with high frequency. Text figure 1, which is definitely median or near-median, shows several distinctive features of this apex:

derivatives of two periclinal divisions are observable at the summit of the shoot apex. An anticlinal mitosis on the left flank indicates that cell division is active. Both leaf primordia show periclinal divisions at their tips.

In text figure 2, the periclines in the surface layer of the leaf primordia apices stand out particularly well. This section is only eight micra removed from that of text figure 1, being the adjacent cut. In this diagram, part of the wall of one of the periclinal

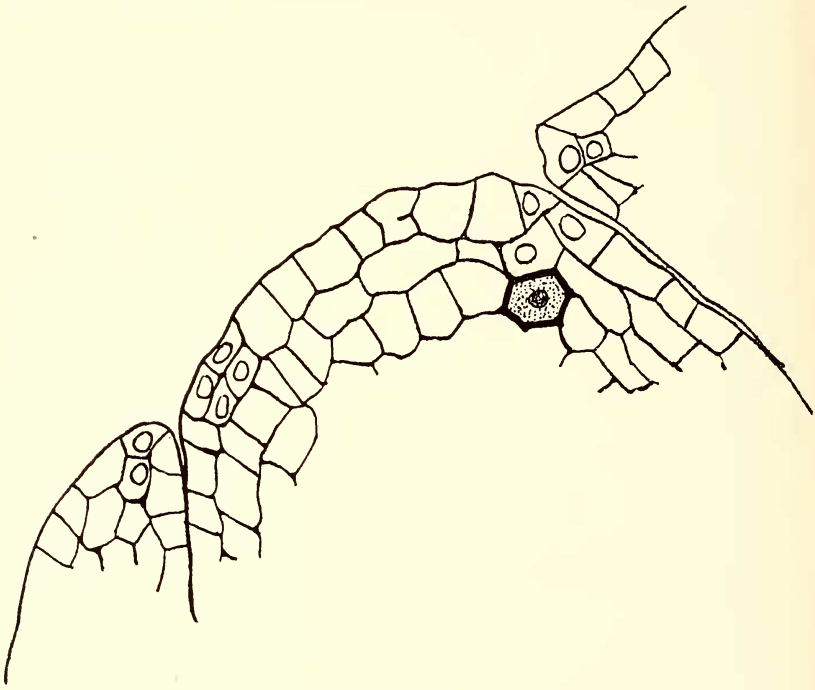

Fig. 2. Longitudinal section of shoot apex of *Chlorogalum pomeridianum*, 8 micra removed from section in fig. 1 (×485).

divisions of the previous section and a different aspect of the second pericline are recognizable at the shoot apex. Periclines are visible on the left flank of the apical cone. The four cells here seem to be the derivatives of a single superficial cell, possibly as a result of a periclinal division immediately succeeded by anticlines in the daughter cells. The heavily-walled, deeply stained cell at the upper right of the figure is seemingly merely coincidental in occurrence in the apex.

Discussion

Agnes Arber (1) has noted, in her discussion of the morphological nature of leaf and shoot, the general equivalence of

"tunica" and "corpus" in the initial regions of stem and leaf in angiosperms as well as the similarity, and even concurrence, in the manner of apical growth of these two organs in most of the general divisions of plants. This thesis is also a point of departure for Catalano's (4) support of Delpino's phytonic concept. These generalizations, however, are merely philosophical derivations from a group of basic anatomical data.

However, at present considerable data have been accumulated on the behavior of leaf and shoot apices in the monocots. The occurrence of periclinal divisions in the surface layer of the leaf apex of these plants is a well-established fact. As Sharman (11) points out, "In the Dicotyledons it may be involved in the production of the leaf edge, while in the Monocotyledons it is frequently concerned in the initiation of the leaves and often contributes considerably to their inner tissues." Sharman has cited most of the investigators who have observed periclines in the dermatogen of the monocot and dicot leaves. To his list can be added the works of Renner (9), Buder (3), Pottier (8), and Schalscha-Ehrenfeld (10).

It appears likely, therefore, that the shoot apices in monocots might possibly have some tendency toward occasional periclinal divisions in the surface layer. A further study of *Chlorogalum* and related plants would help to cast more light on the present rigid concept of "tunica" behavior in angiosperms.

Department of Botany,
University of California, Berkeley,
December, 1943.

Literature Cited

1. Arber, A. The interpretation of leaf and root in the angiosperms. Biol. Rev. 16: 81–105. 1941.
2. Ball, E. The development of the shoot apex and of the primary thickening meristem in Phoenix canariensis Chaub., with comparisons to Washingtonia filifera Wats. and Trachycarpus excelsa Wendl. Amer. Jour. Bot. 28: 820–832. 1941.
3. Buder, J. Studien an Laburnum Adami II. Allgemeine anatomische Analyse des Mischlings und seiner Stammpflanzen. Zeits. f. indukt. Abstammungslehre 5: 209–284. 1911.
4. Catalano, G. La natura morfologica dell'apice vegetativo dei germogli alla luce della dotrina del fillopodio. Nuovo Giorn. Bot. Ital. 45: 594–598. 1938.
5. Foster, A. S. Problems of structure, growth and evolution in the shoot apex of seed plants. Bot. Rev. 5: 454–470. 1939.
6. ————. Comparative studies on the structure of the shoot apex in seed plants. Bull. Torrey Bot. Club 68: 339–350. 1941.
7. Magnus, P. Bemerkungen zu J. H. L. Flögels Präparaten. Cited in O. Schüepp's Meristeme. 1926. Linsbauer's Handb. d. Pflanzenanat. B. IV. 1 Abt. 2 T. 1878.
8. Pottier, J. Contribution a l'étude du développement de la racine de la tige et de la feuille des phanerogames angiospermes. Les monocotylédones marines méditerranéennes Ruppia maritima L., Cymodocea nodosa (Ucria) Ascherson et Posidonia oceanica (L.) Delile de la famille des potamogétonacées. Besançon. 1934.

9. Renner, O. Zur Entwicklungsgeschichte randpanaschierter und reingrüner Blätter von Sambucus, Veronica, Pelargonium, Spiraea, Chlorophytum. Flora 130: 454–466. 1936.
10. Schalscha-Ehrenfeld, M. v. Spross-vegetationspunkt und Blattanlage bei einigen Monokotylen Wasserpflanzen (Potamogeton crispus, Heteranthera dubia, Typha angustifolia). Planta 31: 448–477. 1940.
11. Sharman, B. C. A periclinal division in the 'dermatogen' at the tip of the maize growing point. Nature 146: 778. 1940.
12. ————. A periclinal division in the 'dermatogen' at the growing point of couch grass, Agropyron repens Beauv. Nature 152: 276–277. 1943.

NOTES AND NEWS

Oenothera brachycarpa Gray in Texas. Several collections of this rare and seldom observed *Oenothera* in the subgenus *Megapterium* have been made recently in north central Texas. Citations for these are as follows: breaks along north side of Brazos River, 6.5 miles south of Benjamin, Knox County, May 15, 1941, *Cory 37205* (in flower); Camp Barkeley, Taylor County, April 11, 1943, *Tolstead 6960* (in bud), in red clay soil at west side of camp, July 1, 1943, *Tolstead 7537* (in fruit).

In the description of the subgenus *Megapterium* (North American species of the subgenera *Lavauxia* and *Megapterium* of the genus *Oenothera*. Amer. Jour. Bot. 17: 363. 1930), Dr. Philip A. Munz states, "Seeds as in *Lavauxia,* but in one row in each cell of the capsule, and with corky tubercles." Examination of the capsules of the above cited fruiting specimen of *Oe. brachycarpa* shows the seeds to be arranged in two rows in the capsules as in the subgenus *Lavauxia.* This is also true for *Oe. Wrightii* (regarded as a variety of *Oe. brachycarpa* by some). *Oenothera missouriensis* and its relatives, also members of the subgenus *Megapterium,* do, however, have their seeds arranged in one row in the capsule. V. L. Cory, Texas Agricultural Experiment Station.

The following two items were received too late for review in this issue of Madroño but mention is here made to call them to the attention of our readers. Under the title "The Citrus Industry" by H. J. Webber and L. D. Batchelor (University of California Press) an amazing lot of strictly botanical information is hidden. For instance, Chapter IV by Walter T. Swingle, contains 345 pages entitled "The Botany of Citrus" and comprises a taxonomic monograph of the Aurantioideae of the Rutaceae. Chapter VI deals with the general morphology, histology and physiology of the group and is under the authorship of E. T. Bartholomew and H. S. Reed. The second item is "The Flowering Plants and Ferns of Mount Diablo, California" by Mary L. Bowerman, published by the Gillick Press, Berkeley, California.